

USN

18PHY12

First Semester B.F. Degree Examination, Dec.2018/Jan.2019
Engineering Physics

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Physical constants : Velocity of light, $c = 3 \times 10^8$ m/s
Planck's constant, $h = 6.63 \times 10^{-34}$ Js
Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg.
Charge of electron, $e = 1.6 \times 10^{-19}$ C
Boltzmann constant = 1.38×10^{-23} JK⁻¹
A vavadro number = 6.02×10^{23} /mol.
Module-1

- 1 a. What are shock waves? Mention the characteristics and applications of shock waves. (06 Marks)
- b. What are damped oscillations? Give the theory of damped oscillations and hence discuss the case of critical damping. (10 Marks)
- e. A free particle is executing simple harmonic motion in a straight line with a period of 25 seconds; 5 seconds after it has crossed the equilibrium point, the velocity is found to be 0.7 m/s. Find the displacement at the end of 10 seconds and also amplitude of oscillations. (04 Marks)

OR

- 2 a. Define SHM. Mention the characteristics of SHM. Give one example of SHM. (06 Marks)
- b. With a neat diagram, explain the construction and working of Reddy's shock tube. Mention conservation of mass energy and momentum expressions. (10 Marks)
- c. A mass of 0.5kg causes an extension of 0.03m in a spring and the system is set for oscillations. Find i) The force constant for the spring ii) Angular frequency and iii) Time period of the resulting oscillation. (04 Marks)

Module-2

- 3 a. State and explain Hooke's law. Define elastic and plastic limits. (06 Marks)
- b. Define Young's modulus of materials. Derive an expression for the Young's modulus of a beam using single cantilever method. (10 Marks)
- Calculate the torque required to twist a wire of length 1.5m, radius 0.0425×10^{-2} m through an angle of $(7\pi/45)$ radians, if the value of rigidity modulus of the material is 8.3×10^{10} N/m². (04 Marks)

OR

- 4 a. What is Bending moment? Mention various types of beams and their engineering applications (any four). (06 Marks)
- b. What are the types of Elastic moduli? Derive a relation between Y, K and γ . (10 Marks)
- c. Calculate the Force required to produce an extension of 1 mm in steel wire of length 2m and diameter 1 mm. ($Y = 2 \times 10^{11}$ N/m²) (04 Marks)

18PHY12

*Min% .0 two.

Module-3

- 5 a. What is Numerical Aperture? Derive an expression for the same. (06 Marks)
- b. State and explain Maxwell's equation for electromagnetic field. Starting from Maxwell's equations, deduce the wave equation for a plane wave in free space. (10 Marks)
- c. Determine constant C, such that. $A = (x + ay)a + (y + bz)a + (x + cz)6$. \vec{A} is solenoidal. (04 Marks)

OR

- 6 a. Explain the types of fiber losses. (06 Marks)
- b. State and explain Gauss Divergence theorem. Mention the Stoke's theorem. (10 Marks)
- c. The refractive indices of core and clad are 1.50 and 1.48 respectively in an optical fiber. Find the numerical aperture and angle of acceptance.. (04 Marks)

Module-4

- 7 a. Setup one dimensional time independent Schrodinger wave equation. (06 Marks)
- b. Mention the three modes of vibration in CO_2 molecule. With neat diagrams explain the construction and working of CO_2 laser. (10 Marks)
- c. A pulsed laser emits photons of wavelength 780nm with 20mW average power/pulse. Calculate the number of photons contained in each pulse if the pulse duration is 10ns. (04 Marks)

OR

- 8 a. Prove that electron cannot exist inside the Nucleus of an atom. (06 Marks)
- b. Derive an expression for energy density in terms of Einstein's coefficients. (10 Marks)
- c. An electron is bound in a one dimensional potential well of width 1\AA , but infinite wall height. Find its energy values in the ground state and in the first two excited states. (04 Marks)

Module-5

- 9 a. What are the assumptions of Quantum Free Electron Theory (QFET)? Explain the merits of QFET. (06 Marks)
- b. What is Hall Effect? Derive an expression for Hall voltage in terms of Hall coefficient. (10 Marks)
- c. Find the temperature of which there is probability that a state with an energy 0.5eV above the Fermi energy is occupied. (04 Marks)

OR

- 10 a. What is polarization? Explain various types of polarizations mechanisms. (06 Marks)
- b. What is Fermi Energy? Derive an expression for Fermi Energy at zero Kelvin for a metal. (10 Marks)
- c. The resistivity of intrinsic germanium at 27°C is equal to 0.47 ohm-m. Assuming the electron and hole mobilities as 0.38 and $0.18\text{ m}^2/\text{V-Sec}$ respectively. Calculate the intrinsic carrier density. (04 Marks)